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ABSTRACT

This study investigated the efficiency of video as an additional teaching aid for a statistics course offered by the Fernuniversitat (Open University, West Germany). A total of 65 distance students and internal students from the Universities of Bochum and Dortmund were divided into five groups to test the effects of five alternative treatments: (1) written original version of material for course entitled Econometrics I (version O); (2) a lexivisually and didactically developed written version (version A); (3) video as a pre-orientation to version A; (4) the text of version A with video used to review course materials; and (5) video as a pre-orientation to version O. Results of a comprehensive test indicated that all three test groups which were supported by video in their textual treatment obtained higher average point scores in the main test, although the expected time-savings with the pre-orientation video were not realized. There were no significant differences in performance between the groups using the alternative versions of the written materials. It is suggested that future studies should use larger groups, greater homogeneity of test subjects (i.e., external students only), a larger number of playback facilities, and a shorter total test duration. (CGD)

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NO. 4

VIDEO AS SUPPLEMENTARY MATERIAL

The Impact of an Alternative Development of Study Materials in Solving Formal Economic Problems

W. Laaser
in collaboration with
J. Bartels, H. Klein, F.J. Mattes, U. Rossié

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Centre for Distance Study Development, Fernuniversität,
August, 1981.

THE EFFICIENCY OF VIDEO AS SUPPLEMENTARY STUDY MATERIAL
Results of an Experiment

1. THE INVESTIGATORY HYPOTHESIS

In our 1980 experiments we had tested the alternative video versus two written versions, an original version and one lexivisually developed.(1) The results indicate that formal economic problems can also be communicated via the medium of video, but that in the case of the pure opposition of exclusively written material or exclusively audiovisual versions no substantial performance differences between the original version and the video presentation emerged. However, the results show that the lexivisually and didactically developed written version was far superior to both alternatives from the point of view of performance level. With regard to the expenditure of time, the video group, due to the fixed tape-running time, required only approximately half the time to handle the material. We intended to make these results the starting point for a further series of experiments to investigate the efficiency of video as an additional teaching aid. This kind of operation is in keeping with the role assigned to the medium of video in distance studies at Fernuniversitat.

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(1) W. Laaser in collaboration with J.Bartels, V. Hofman, H. Klein, F.J. Mattes, "The Impact of an Alternative Development of Study Materials in Solving Formal Economic Problems, Fernuniversität, Centre for Distance Study Development, August,1980.

Our hypotheses were therefore as follows:

- by means of video as a supplement to written material, an increase in performance can be achieved, measured by the point scores attained in tests versus purely written treatment of the material.
- where video tapes are supplied in addition to the written material as pre-orientation, there can be a time saving factor as well as improved performance.
- where a video tape is used to revise the written material, improvement in performance can be expected in terms of the point scores attained.

2. THE EXPERIMENTAL METHOD

In the test we set out to establish six groups in all, which were to work with the following alternatives:

(1) Written original version of the material for the course entitled "Econometrics 1". (Group O).

(2) Lexivisually and didactically developed written version. (Group A).

(3) Video with the text of version A subsequently supplied. (Group VA).

(4) The text of version A with subsequent use of video. (Group AV).

(5) Video with the text of version O then supplied. (Group VO).

This procedure should indicate to us on the one hand the impact of an additional video usage as against purely written

versions, and, on the other hand, the influence of the time point at which the video material was introduced as pre-orientation or as revision.

3. CONDUCTING AN EXPERIMENT

It was planned to experiment with a group of around 110 students, each group consisting of about 18 students. In order to obtain a correspondingly large group of students, we had cirularized in addition to external students who had chosen the statistics course, statistics students from the universities of Bochum and Dortmund. On the basis of registrations (85), we had then reduced the planned six groups by one (Group OV), since we gave the sequence video first or afterwards a lower priority than introducing the test video as a supplementary medium at all. Furthermore, we expected initial information with regard to the impact of this procedure from the comparison between Groups AV and VA.

Contrary to our expectations that all the enrolees would participate, as had been the case in earlier tests, only 65 students finally participated in the experiment. The group size was accordingly reduced to between 10 and 15 students. Since the group divisions had been made at random, there were, in addition to small group sizes, differing quotas of external and internal students. Since the external students had perhaps handled a material which is part of their curriculum somewhat more

intensively, this factor possibly impaired the quality of later results.

In the course of the experimentation, it was discovered that in the video groups, the individual students advanced at quite differing learning tempos. However, there were insufficient playback possibilities to avoid long periods of waiting for the quicker students. As a result, there was a sporadic lack of motivation towards further treatment of the material and a certain pressure on the "slow learners". Furthermore, because of the length of the comprehensive test (4 - 6 hours), a decline in performance in the handling of the main section was registered, and this varied from group to group. In a similar manner to the preceding experiments, the comprehensive test was structured as follows:

Testing Method

- pre-knowledge (basic knowledge) Part 1 (written)
- pre-test 1 (6 exercises)
- pre-knowledge Part 11
- pre-test 11 (2 exercises)

O	A	AV	VA	VO
Main Sect.1 (Original Version)	Main Sect.1 (Alter. Version)	Main Sect.1 (Alter. Version) Video Pt.1	Video 1 Main Sect.1 (Alter. Version)	Video 1 Main Sect.1 (Original Version)
Main Test 1 (6 exercises)	Main Test 1	Main Test 1	Main Test 1	Main Test 1
Main Sect. 11 (Original Version)	Main Part 11 (Alter Version)	Main Part 11 (Alter Version) Video Part 11	Video 11 Main Part 11 (Alter Version)	Video 11 Main Part 11 (Alter Version)
Main Test 11 (4 exercises)	Main Test 11	Main Test 11	Main Test 11	Main Test 11

For each of these steps the students were supposed to note the time required. The written materials were, in comparison with the earlier tests, only slightly shortened in the main sections, and the test exercises for the easier evaluation were provided even more numerously with prestructured multiple-choice distractors. The video was barely 40 minutes in length, of which approximately another 6.5 minutes were not related to the teaching content (interview and billiard scene). The first section of the video tape lasted around 25 minutes. Then the presentation was interrupted for discussion of the corresponding

written text, and subsequently the second part of the tape was played.

4. THE RESULTS

4.1. THE TOTAL PICTURE

The following table records an initial response to the results:

	Time expenditure in minutes						Point Score	
Group	(1) VK	(2) H	(3) VT	(4) HT	V (1)+(3)	H (2)+(4)	VT	HT
n = 12								
O	67.33	40.83	29.0	25.42	96.33	66.25	19.67	18.58
n = 15								
A	60.13	43.07	31.93	23.87	92.06	66.94	20.60	17.47
n = 14								
AV	68.85	52.58	39.79	31.0	108.64	83.58	22.79	21.07
n = 13								
VA	98.31	56.23	37.0	29.54	135.31	85.77	19.69	22.62
n = 11								
VO	64.73	50.27	31.91	25.27	96.64	75.54	14.73	21.0
n = 65					105.05	75.53	19.50	20.15
					maximum attainable point score		37	43

VK = pre-knowledge section
H = main section
VT = pretest
HT = main test

The result table indicates that our tests suggest that the additional video support affected performance improvement in

point scores. In comparison with the purely written versions, no substantial differences in time expended and in performance manifested themselves in the case of this rough evaluation. Even the time-saving factor with the video does not seem considerable.

We have therefore attempted to scrutinise the results even more closely. As the average pre-test performances and the time expended in working through the pre-knowledge have already shown, the groups were extremely heterogeneous. This is certainly due to small group sizes, but equally due to the extremely heterogeneous pre-knowledge on the part of the test subjects. Because of the anonymity of the original test results, we could not in detail trace back the influence of the individual groups of participants (external students,internal students from Bochum and Dortmund).

4.2. THE IMPACT OF VIDEO SUPPORT

4.2.1. POINT SCORES ATTAINED

All three test groups which were supported by video in their textual treatment obtained higher average point scores in the main test. The greatest increase in performance was obtained by group VO which in the pre-test had obtained the worst results.

If we compare the video groups (VO and VA), which used video as preorientation, with the corresponding groups (O and A), which

only handled written versions, then it emerges that the growth of learning by video is significantly set at 5% probabillity of error.

The growth of learning is measured by comparing the individually obtained point scores in percentage of the maximum achievable point scores in the respective test. Formula:

$$\frac{1}{n} \sum_{i=1}^{n} \left(\frac{h_i}{h_{max}} - \frac{v_i}{v_{max}} \right) \cdot 100$$

v_i = individually obtained point score in the pretest

v_{max} = maximum achievable point score in the pretest

h_i = individually achieved point score in the main test

h_{max} = maximum achievable point score in the main test

n = number of test subjects in the respective group

Differential Solutions
HT-VT in %

VO and VA	O and A
+3.51	-12.78
n = 24	n = 27

If test subjects are "medianized" according to their pretest performances, it emerges that the high achievers profit by the introduction of media for pre-orientation somewhat more so than the weaker students (i.e. measured by their point differences between pre- and main test).

Differential Solutions
HT-VT in %

	weaker students	higher achievers
with video VO,VA	5.33	0.47
without video O,A	-1.88	-21.50

4.2.2. TIME EXPENDED

Time saving in the handling of the text had been expected in the case of video introduction for pre-orientation. In all, we could record such saving of time only in some areas. If again groups O and A are compared with corresponding groups VO and VA, the times required for the main part are, in all, greater than in the case of groups with exclusively written texts. However, time-savings in terms of the introduction of media are discernible when one considers average differences in instruction

times (pure textual treatment) between pre-knowledge and the main section.

Differential instruction time
Main section - Pre-knowledge in mins

with video (VO,VA)	without video (O,A)
- 29.42	- 21.26

For the pre-knowledge generally more time was required than for the main section. Even here it is apparent that particularly the high achievers were able to achieve time-saving through the introduction of media. In the process, the students were again "median ized" according to their pretest performances in terms of points.

Differential Instruction time
Main Section - Pre-knowledge in mins.

	weaker students	higher achievers
with video VO,VA	-22.73	-40.56
without video O,A	-29.50	-14.67

4.3. COMPARISON OF WRITTEN ALTERNATIVES

With regard to written alternatives, the differences in performance behaviour which had clearly emerged in the preceeding tests did not manifest themselves in our experiment. Also, in respect of the required times, a global consideration of the results does not indicate the anticipated greater success of the alternative version. If, however, groups O and VO are taken together and contrasted with groups A and VA, greater time-savings can be registered in the case of the groups which worked with the alternative written version.

ϕ Differential in the instruction time. Main section - Pre-knowledge section in mins.	
O, VO n = 23	-20.74
A, VA n = 28	-28.68

4.4. OBSERVATIONS ON PERFORMANCE BEHAVIOUR IN GENERAL

As in the case of the previous experiments, it emerged that the point scores achieved in the main test for the total group of subjects can be positively correlated with the pre-test performances (r = 0.537).

SPSS Batch system
Leistung = performance
Vortest = pre-test
Haupttest = main test

A similar relationship exists for the time required in the pre-knowledge part compared with the time expended in the main part. ($r = 0.443$).

Gesamtzeit = total time
Vorkenntnisse = pre-knowledge
Hauptteil = main part

The negative relationship observed in the earlier investigations between time expended for the instruction part and the point values attained in the test exercises did not occur this time in this form. However, the correlation was not significantly positive, which indicates that the individual learning performance components i.e. learning tempo and performance attained, were here much more independent of each other. High achievers are not always quicker in handling the material. The weaker students attempt to increase the time expended on the material, or they simply give up.

The following table shows how heterogeneous behaviour was within the individual groups:

Achievement in Main Test in Points

	O	A	AV	VA	VO
quick group	20.88	15.50	23.83	-	19.14
slow group	14.0	25.33	19.38	22.62	23.50

The division according to learning speed was undertaken through "medianization" in accordance with the time required for giving instructions in the pre-knowledge section. In particular, both groups with exclusively written texts present a completely different picture. Possibly, the alternative version inspired the slower group to improve performance rather than the group with the original version.

If the pre-test scores are compared with the point scores achieved in the main test, the degree of proximity of the average point scores to the maximum attainable point scores indicates a decline in performance right up to the main test. The drop in performance indicates fatigue or lack of enthusiasm on the part of the students, probably co-conditioned by the duration of 4 to 5 hours. The regression in performance is highest with those groups which worked exclusivley with written texts. Only Group VO could, to a certain extent, keep up its level of performance. With the video groups the regression in performance was generally less significant.

Solutions Main Test - Pretest in %

	O	A	AV	VA	VO
students with below average performance	1.93	-5.68	-3.03	1.98	8.27
students with above average performance (2)	-21.80	-21.31	-17.11	-3.68	8.76

In addition , it is apparent that the regression in performance was considerable, particularly in the case of students with above average performances.

5. CONCLUSIONS FOR FURTHER INVESTIGATIONS

Our tests show that the addition of video can be a suitable means of improving performance. However, its introduction for the student, despite some temporal savings when working through written texts via films for pre-orientation, is generally linked with a greater total expenditure of time. This means that in distance studies such a path towards performance improvement should only be traversed when, even after written optimization of the material, no sufficient performance improvements can be attained, or when the video film, as a supplement to increase learning performance, is able to better exemplify the structure of the problem,or when the video film can fulfil a motivational function more effectively than written material or an audio-cassette.

Our individual results are relatively tentative. Our experiments serve more a hypothesis-differentiation than a strict falsification of known individual hypotheses. Also the supplementary video material could be conceived of specifically in terms of its function as pre-orientation or as revision. The

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(2) Medianization according to pretest results.

tape used hitherto had simply served the function of relaying the teaching material video-wise according to the agreed teaching objectives, which also had validity for the written alternatives.

In each case the laboratory experiments would have to entail:

- larger groups

- greater homogeneity of test subjects
  (no mixture of external and internal students)

- a larger number of playback facilities

- a shorter total test duration.

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